HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Issaquah Coho Program
Species or Hatchery Stock:	Coho (*Onchorynchus kisutch*) Issaquah Creek
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Issaquah Creek (Lake Washington) Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	January 15, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Issaquah Coho Program

1.2) Species and population (or stock) under propagation, and ESA status.

Issaquah Creek (Lake Washington) Coho (*Onchorynchus kisutch*) - not listed

1.3) Responsible organization and individuals

Name (and title):	Chuck Phillips, Region 4 Fish Program Manager	
	Doug Hatfield, Snohomish Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
Address:	600 Capitol Way North, Olympia, Wa. 98501-1091	
Telephone:	(425) 775-1311 Ext 120	(360) 793-1382
Fax:	(425) 338-1066	(360) 793-9558
Email:	**phillcep@dfw.wa.gov**	**hatfidgh@dfw.wa.gov**

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

In addition to the on-station production at Issaquah Hatchery, eggs (975,000) and fish (60,000) are given to local schools and volunteer cooperative projects.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

State General Fund.

1.5) Location(s) of hatchery and associated facilities.

Issaquah Hatchery: Issaquah Creek (08.0178) at RM 3 in downtown Issaquah.

1.6) Type of program.

Isolated harvest

1.7) Purpose (Goal) of program.

Augmentation

The goal of this program is to provide fish for harvest opportunity.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse genetic, demographic or ecological effects on listed fish. This will be accomplished in the following manner:

1. Release coho as smolts with expected brief freshwater residence.

2. Time of release not to coincide with out-migration of listed fish.

3. Only appropriate stock will be propagated.

4. Mark all reared fish.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g. NPDES criteria.

1.9) List of program "Performance Standards".

See below

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

Performance Standards and Indicators for Puget Sound **Isolated Harvest** Coho programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Meet hatchery production goals	Number of juvenile fish released - **450,000**	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records

Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **1,000-2,000**	Rack counts and CWT data
	Stray Rates	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **October thru mid-Nov**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
	Total number of wild adults passed upstream - **Unknown**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - **May (chinook)/April**	FBD and historic natural outmigration times
	Size and time of release - **17 fpp/April release**	FBD and hatchery records
	Hatchery stray rates	CWT data and hatchery records (marked vs unmarked)
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health Monitoring Records
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

1,000-2,000 adults.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Issaquah Creek (08.0178)	450,000

*-975,00 eggs are transferred to various schools and volunteer co-op projects within the watershed for incubation and release.

**-30,000 fish are transferred to Laebugton Net Pens for rearing and release and 30,000 fish are transferred to the Ballard Net Pens for rearing and release.

***- Since 1995 BY, 1,000,000 fed fry are no longer planted into local Lake Washington streams.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

For the most recent broodyears coded-wire tagged, 1977-1979, the smolt-to-adult survival rates were 10.73%, 7.24% and 11.01%, respectively. The hatchery escapement levels for years 1995 through 2001 were 31,366, 15,032, 7,961, 3,384, 2,963, 27,225 and 39,086, respectively.

1.13) Date program started (years in operation), or is expected to start.

1935

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Lake Washington watershed (08)
-Issaquah Creek (08.0178)

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

NA

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

None

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- Identify the ESA-listed population(s) that will be directly affected by the program.

None

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Issaquah (Lake Washington) Summer/Fall Chinook

Most naturally-spawned Lake Washington chinook migrate to salt water after spending only a few months in freshwater. Arrival of both hatchery and naturally-produced smolts in the estuary peaks in late May, and after a few weeks, most begin moving to near-shore feeding grounds in Puget Sound and the Pacific Ocean. Sexually mature fish begin arriving back at the Ballard Locks as early as June. The peak counts at the Chittenden Locks is usually in early to mid-August.

N. Lake Washington Tribs Summer/Fall Chinook, Cedar River Summer/Fall Chinook

There are naturally spawning adult chinook in tributaries throughout the Lake Washington basin, however, their genetic origin is uncertain. There are genetically distinct chinook in the Cedar River. Adults spawn in the mainstem Cedar River from about river mile 1.0 in Renton to the City of Seattle water pipeline crossing at river mile 21.3. In 1999, 81% of the chinook redds were observed above river mile 6.5 and the first redd observed was on August 18. Spawning activity peaks in early October and is generally complete by early to mid-November. Big Bear/Cottage, Issaquah, and Kelsey Creeks also have significant numbers of spawners. Recent genetic testing (1999 broodyear) of Bear Creek chinook indicate that they are very similar to the Issaquah Hatchery stock.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

Critical and viable population threshholds under ESA have not been determined, however, the SASSI report (WDFW) determined this population (Issaquah Summer/ Fall Chinook) status to be "healthy" while the North Lake Washington tribs and Cedar River Summer/Fall chinook are "unknown.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The table below provides the Lake Washington chinook broodyear live count Area Under the Curve index spawning escapement, subsequent reconstructed run size and return per spawner. This information is for natural spawners in Bear/Cottage and the Cedar River mainstem. The source of these data are from WDFW run reconstruction tables.

Return Year	Run size	Brood Year Index Escapement	Return/ Spawner
1988	2,769	1,252	2.2117
1989	1,832	949	1.9305
1990	1,214	1,470	0.8259
1991	1,517	2,038	0.7444
1992	1,407	792	1.7765
1993	321	1,011	0.3175
1994	924	787	1.1741
1995	969	661	1.4660
1996	345	790	0.4367
1997	305	245	1.2449
1998	700	888	0.7883
1999	780	930	0.8387
2000		336	
2001		294	

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Live count Area Under the Curve index spawning escapement estimates for the Cedar River mainstem, Bear Creek and Cottage Lake creeks. There is no expansion to un-surveyed sections or for fish not seen (WDFW data).

Return Year	Cedar	Cottage	Bear	System Total
1983	788	403	141	1332
1984	898	264	90	1252
1985	766	124	59	949
1986	942	386	142	1470
1987	1540	226	272	2038
1988	559	50	183	792
1989	558	208	245	1011
1990	469	161	157	787
1991	508	93	60	661
1992	525	75	190	790
1993	156	44	45	245
1994	452	186	250	888
1995	681	143	106	930
1996	303	11	22	336
1997	227	42	25	294
1998	432	192	73	697
1999	241	258	279	778
2000	120	97	130	347

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

There are no estimates of direct hatchery-origin chinook on the spawning grounds. There are no recent coded-wire tag releases in the Lake Washington system, therefore, there are no adipose-fin clipped released chinook. The 2000 releases were mass marked (adipose-fin clip only) so the hatchery percentages may be available in the future. It is assumed that a high percentage of natural spawners in Issaquah Creek are of hatchery origin.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u> *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

Collection of steelhead broodstock takes place between December and early March oustide the retum time of the spring, summer and fall chinook runs. No likely effects to "take" of listed chinook.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Unknown

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" table

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Take levels have been unknown so no contingency plans have been established. Starting in 2003, these hatchery fish will be identifiable. WDFW will consult with NMFS to develop a contingency plan and in any case where take levels are exceeded or are projected to exceed the take levels in the plan, WDFW will consult with NMFS in a timely manner.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

There are no ESU-wide hatchery plans or other regionally accepted policies currently in place.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

Eggs and fish are provided to the Muckleshoot Tribe as defined in the Future Brood Document. Puget Sound Salmon Management Plan.

3.3) Relationship to harvest objectives.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Most recent tagged groups were in the late 70's, so no recent data on catch contributions has been analyzed and compiled. Target fishers are Washington recreational, commercial and tribal fishers.

3.4) Relationship to habitat protection and recovery strategies.

The comanagers' resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement

Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

Predation – Freshwater Environment

Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.

Relative Body Size. The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stillaguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et. (2002).
[5] Data are from Samarin and Sebastian (2002).
[6] Data are from Marlowe et al. (2001).

Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:
[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from Seiler et al. (2003).
[3] Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et al (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et al (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et al (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation – Marine Environment
WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

> "1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984)."
>
> "2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simenstad and Kinney 1978)."
>
> "3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance."

Competition
WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

> 1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids."
> 2) NMFS (2002) noted that "..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."
> 3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern

enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."
4) Fresh (1997) noted that "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The main source of water is from the main fork of the Issaquah Creek. There are two intake sources on this stream. Located approximately three quarters of a mile up stream is a small dam with intake screens that feed water to the hatchery by gravity. This produces about 5,000 gallons per minute (gpm). There are also five pumps that provide 5,500 gpm. This is a small urban stream whose flow rates and heights change rapidly with weather conditions. The daily temperature differences can be 10º Fahrenheit between day and night and range from 30º to 75º Fahrenheit depending upon the time of year. NPDES permit # is WAG-133010.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The upper intake screens do not meet NMFS screening guidelines, but changes are forthcoming. WDFW and the Corp of Engineers are developing plans, under the COE 206 Habitat Restoration Authority, to replace and/or remodel the intake structure to bring it into full compliance for adult and juvenile passage. The lower intake screens meet current guidelines.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The Issaquah Hatchery has one adult collection facility. It is made up of two 100' X 20' X 6' adult capture ponds. An air-bladder weir is attached above the lower intake screens. This weir and a bar rack at the mouth of the by-pass fish ladder keep the fish from going upstream when trapping. Trapping begins at the end of August (chinook) and ends in the middle of November. The fish are encouraged to migrate up the adult pond's fish ladder which its' entrance is at the base of the weir. The source of water for these ponds is pumped from the lower intake screens.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

NA

5.3) Broodstock holding and spawning facilities.

The collection facilities described in section 5.1 also serves as spawning facilities.

5.4) Incubation facilities.

At present eggs are reared in deep troughs, shallow troughs, and vertical Heath Techna incubators. After the year 2001 egg take, all eggs were incubated in the vertical incubators.

5.5) Rearing facilities.

There are four sizes of rearing vessels used at Issaquah: 100' X 10' X 4', 100' X 20' X 4', 100' X 20' X 5', and 80' X 20' X 5'. Fish are reared in any combination of these ponds and released from these ponds into Issaquah Creek.

5.6) Acclimation/release facilities.

See section 5.5

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Because surface water is the source for the hatchery, the threats from diseases and parasites present the most significant threat to fish health. The high sediment loads during flood conditions cause loss of growth and environmental health problems with the eggs and fish.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Issaquah Hatchery is staffed with four full time employees one of which is on a standby status 24 hours a day seven days a week. All staff are very familiar with the workings of the hatchery and have received training in fish cultural techniques and disease recognition and prevention issues. Additionally, pathology staff make frequent visits to the hatchery to check the health of fish stocks and are available immediately in case of a disease outbreak. The hatchery is equipped with a sophisticated alarm system that monitors flow and other conditions critical to hatchery operations. There is a standby power generator that is capable of supplying electrical needs to the pumps in case of a loss of power.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Adults returning to the Issaquah Hatchery trap.

6.2) Supporting information.

6.2.1) History.

Since it's inception in 1936, the Issaquah Hatchery has had two primary sources of broodstock; the first being the adults collected locally at the hatchery and the second being fish supplied from the WDFW hatchery at Soos Creek on the Green River (no longer being done).

6.2.2) Annual size.

The annual goal is to collect 1,000-2,000 fish as broodstock with annual equal number of males and females in the population.

6.2.3) Past and proposed level of natural fish in broodstock.

All hatchery produced coho have been mass marked since 1996 BY and can be identified by the lack of an adipose fin. Only hatchery origin fish are utilized for broodstock purposes.

6.2.4) Genetic or ecological differences.

None.

6.2.5) Reasons for choosing.

Local adapted stock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

NA

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults

7.2) Collection or sampling design.

The adult trap and air-bladder weir is operated from the last week of August until mid-November. Trapping efficiency is very much dependent on water flows. During high water events(late October on) fish can either jump or swim over the air-bladder weir.

7.3) Identity.

All coho returning to the hatchery (beginning in 1999) are 100% identified with an adipose-fin clip (mass marked).

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

1,000-2,000 (500-1,000 females; 500-1,000 males)

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995	1,323	1,135		3,760,000	
1996	2,477	2,602		4,173,800	
1997	1,931	1,636		3,422,000	
1998	1,389	1,382		2,946,900	
1999	1,123	1,234		2,828,000	
2000	1,348	1,420		3,566,660	
2001	788	751		2,011,000	

Data source: Issaquah hatchery records

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

For broodstock purposes fish are collected over the entire length of the run. The vast majority of fish that are not needed for spawning are returned to the river and allowed to spawn naturally. A minimal number of fish are processed to a contract buyer or used for nutrient enhancement in local streams.

7.6) Fish transportation and holding methods.

NA

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult broodstock are sampled for virus in accordance with the Co-Managers Disease Policy and spawning procedures follow the guidelines set forth in the hatchery division Fish Health Manual.

7.8) Disposition of carcasses.

Spawned or un-spawned carcasses are typically sold to a fish buyer, otherwise, a minimal number of fish used for nutrient enhancement in local streams.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock collection for Issaquah Creek coho may result in take of listed Puget Sound fall chinook through capture at the hatchery trap in October.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Adult coho are selected randomly over the entire run.

8.2) Males.

No back up males or repeat spawners are used. Jacks are spawned at a rate of 2% over the spawning season.

8.3) Fertilization.

Equal sex ratios are used and gametes are pooled in lots of 5.

8.4) Cryopreserved gametes.

NA

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

NA

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Typical survival of egg to fry is 90%.

9.1.2) Cause for, and disposition of surplus egg takes.

Current management approaches do not allow for the taking of eggs in surplus of program goals. If losses are too high, then goals are not met.

9.1.3) Loading densities applied during incubation.

Coho eggs are loaded into shallow trough incubators at a rate of 25,000 eggs per section.

9.1.4) Incubation conditions.

Temperature of inflowing water is monitored and recorded daily. Dissolved oxygen is checked on an infrequent basis and silt management is accomplished by flushing trays and deep troughs and brushing screens. The eggs in the shallows and verticals have to be gently washed to remove silt.

9.1.5) Ponding.

Temperature units, weight samples and kd index are all utilitized to determine the appropriate time to pond fry. All fry are force ponded.

9.1.6) Fish health maintenance and monitoring.

All incubators are subject to a daily 15 minute 1:600 drip of formalin for the control of fungus and disease in the trays. These treatments start 2 days after initial fertilization and continue until approximately 1 week from hatching. When eggs reach the "eyed" stage they are removed from the trays and shocked. At this point, all non-viable eggs are removed either by the use of an automated egg picker or by hand.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

NA

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

9.2.2) Density and loading criteria (goals and actual levels).

Numerous criteria are applied depending on the fish's size, the pond style they reside in, water quality, water temperature, relative health and water conditions. However, as a rule, the criteria limits loadings to a maximum of 3 pounds fish per gallon per minute (gpm) of flow until they have reached a size of 100 fish per pound (fpp).

9.2.3) Fish rearing conditions

Water temperatures are monitored on a daily basis. Water flows are checked at least weekly. Each pond is monitored for loss and loss is picked daily. Ponds are vacuumed on an as-needed basis (typically weekly). General health of the fish is monitored by Fish Health staff on a biweekly basis.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Not available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Diets supplied by Moore-Clark and BioOregon are used in rearing Issaquah coho. The diets are typicially "dry" or "semi-dry" in nature and included starter diets, crumbles and pellet type feeds. Daily percent of body weight fed varies depending on the size of the fish, temperature of the water and time of year. However, the range is usually from 1-3% B.W./day. Overall food conversion is typically 1.1 to1.2.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Sanitation procedures include the use of iodophore solutions as disinfectant for tools and nets and other equipment used between ponds and stocks of fish. Fish Health staff monitor the fish on a biweekly basis and disease treatment is done on an as-needed basis.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

NA

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

NA

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

NA

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	450,000	17	April	Issaquah Creek

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Issaquah Creek (08.0178)
Release point: Issaquah Creek (RM 3)
Major watershed: Issaquah Creek (Lake Washington)
Basin or Region: Puget Sound

10.3) Actual numbers and sizes of fish released by age class through the program.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							568,000	16
1996			335,576	987	202,906	264	536,100	18
1997			770,800	1,200	384,734	342	505,216	20
1998			495,800	1,429			405,400	17
1999			115,350	695	93,090	270	409,000	18
2000							545,000	17
2001			1,744,949	1,381			505,600	18
Average			692,495	1,138	226,910	292	496,331	18

Data source: Issaquah hatchery records

10.4) Actual dates of release and description of release protocols.

10.5) Fish transportation procedures, if applicable.

NA

10.6) Acclimation procedures.

Fish are incubated/reared strictly on Issaquah Creek water.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

As of 1996 broodyear, all coho are 100% identified with an adipose-fin clip (mass marked).

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

None.

10.9) Fish health certification procedures applied pre-release.

Fish Health staff evaluates the fish a maximum of 2 weeks prior to release.

10.10) Emergency release procedures in response to flooding or water system failure.

In the case of a catastrophic event condition critical to the fish's survival, health would be monitored and, if deemed necessary, the fish would be released prematurely to prevent their loss in the ponds.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

To minimize the risk of residualization and impact upon natural fish, hatchery yearlings are released in April as smolts. All fish released will be mass marked.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

The comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;

b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;

c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;

d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?

b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?

c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

See Section 11.1.1.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Not applicable.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

12.6) Dates or time period in which research activity occurs.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8) Expected type and effects of take and potential for injury or mortality.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

12.10) Alternative methods to achieve project objectives.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality."*).

SECTION 13. ATTACHMENTS AND CITATIONS

Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.

Brodeur, R. D. 1991. Ontogenetic variations in the type and size of prey consumed by juvenile coho, Oncohynchus kisutch, and chinook, O. tshawytscha, salmon. Environ. Biol. Fishes 30: 303-315.

Cardwell, R.D., and K.L. Fresh. 1979. Predation upon juvenile salmon. Draft technical paper, September 13, 1979. Washington Department of Fisheries. Olympia, Washington.

Flagg, T.A., B.A. Berejikian, J.E. Colt, W.W. Dickhoff, L.W. Harrell, D.J. Maynard, C.E. Nash, M.S. Strom, R.N. Iwamoto, and C.V.W. Mahnken. 2000. Ecological and behavioral impacts of artificial production strategies on the abundance of wild salmon populations. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-41: 92p.

Fresh, K.L. 1997. The role of competition and predation in the decline of Pacific salmon and steelhead. *In* D.J. Stouder, P.A. Bisson, and R.J. Naiman (editors), Pacific salmon and their ecosystems: status and future options, p. 245-275. Chapman Hall, New York.

Gregory, S.V., G.A. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell. 1987. Influence of forest practices on aquatic production. *In* E.O. Salo and T.W. Cundy (editors), Streamside management: forestry and fishery interactions. Institute of Forest Resources, University of Washington, Seattle, Washington.

Griffith, J., R. Rogers, J. Drotts, and P. Stevenson. 2001. 2001 Stillaguamish River smolt trapping project. Stillaguamish Tribe of Indians, Arlington, Washington.

Griffith, J., R. Rogers, J. Drotts, and P. Stevenson. 2003. 2002 Stillaguamish River smolt trapping project. Stillaguamish Tribe of Indians, Arlington, Washington.

Harza. 1999. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol 2, pp 35-42.

Hochachka, P.W. 1961. Liver glycogen reserves of interacting resident and introduced trout populations. Can. J. Fish. Aquat. Sci. 48: 125-135.

Johnston, J.M. 1967. Food and feeding habits of juvenile coho salmon and steelhead trout in Worthy Creek, Washington. Master's thesis, University of Washington, Seattle.

Kline, T.C., J.J. Goring, Q.A. Mathisen, and P.H. Poe. 1997. Recycling of elements transported upstream by runs of Pacific salmon: I $d^{15}N$ and $d^{13}C$ evidence in Sashin Creek, southeastern Alaska. Can. J. Fish. Aquat. Sci. 47: 136-144.

Levy, S. 1997. Pacific salmon bring it all back home. BioScience 47: 657-660.

Lister, D.B., and H.S. Genoe. 1970. Stream habitat utilization by cohabiting underyearlings of chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) in the Big Qualicum River, British Columbia. J. Fish. Res. Board. Can. 27: 1215-1224.

Marlowe, C., B. Freymond, R.W. Rogers, and G. Volkhardt. 2001. Dungeness River chinook salmon rebuilding project: progress report 1993-1998. Report FPA 00-24. Washington Department of Fish and Wildlife, Olympia, Washington.

Marshall, Anne R. 1999. Genetic Analysis of Bear Creek/Cottage Lake Creek Naturally Spawning Fall-Run Chinook. Washington Department of Fish & Wildlife Genetics Unit. 8 p.

Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: 2249-2258.

Miller, R.B. 1953. Comparative survival of wild and hatchery-reared cutthroat trout in a stream. Trans. Am. Fish. Soc. 83: 120-130.

NMFS (National Marine Fisheries Service). 2002. Biological opinion on artificial propagation in the Hood Canal and eastern Strait of Juan de Fuca regions of Washington State. National Marine Fisheries Service, Northwest Region.

Nilsson, N.A. 1967. Interactive segregation between fish species. *In* The biological basis for freshwater fish production. *Edited by* S.D. Gerking. Blackwell Scientific Publications, Oxford. pp. 295-313.

Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. l. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6.

Peterman, R.M., and M. Gatto. 1978. Estimation of the functional responses of predators on juvenile salmon. J. Fish. Res. Board Can. 35: 797-808.

Peterson, G.R. 1966. The relationship of invertebrate drift abundance to the standing crop of benthic drift abundance to the standing crop of benthic organisms in a small stream. Master's thesis, Univ. of British Columbia, Vancouver.

Reimers, N. 1963. Body condition, water temperature, and over-winter survival of hatchery reared trout in Convict Creek, California. Trans. Am. Fish. Soc. 92: 39-46.

Samarin, P., and T. Sebastian. 2002. Salmon smolt catch by a rotary screwtrap operated in the Puyallup River: 2002. Puyallup Indian Tribe.

Seidel, Paul, 1983, Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries, Washington Department of Fish and Wildlife, Olympia

Seiler, D., P. Hanratty, S. Neuhauser, P. Topping, M. Ackley, and L.E. Kishimoto. 1997. Wild salmon production and survival evaluation. Annual Report. RAD 97-03. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 1998. 1997 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 1999. 1998 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 2000. 1999 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 2001. 2000 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., L. Kishimoto, and S. Neuhauser. 2002. 2001 Skagit River wild 0+ chinook production evaluation. Contract report to Seattle City Light. Report FPA 02-11. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., G. Volkhardt, and L. Kishimoto. 2003. Evaluation of downstream migrant salmon production in 1999 and 2000 from three Lake Washington tributaries: Cedar River, Bear Creek, and Issaquah Creek. Report FPA 02-07. Washington Department of Fish and Wildlife, Olympia, Washington.

Seiler, D., G. Volkhardt, L. Kishimoto, and P. Topping. 2002. 2000 Green River juvenile salmonid production evaluation. Report FPT 02-03. Washington Department of Fish and Wildlife, Olympia, Washington.

Simenstad, C.A., and W.J. Kinney. 1978. Trophic relationships of out-migrating chum salmon in Hood Canal, Washington, 1977. Univ. of Washington, Fish. Res. Inst., Final Rep., FRI-UW-8026.

Slaney, P.A., B.R. Ward. 1993. Experimental fertilization of nutrient deficient streams in British Columbia. *In* G. Schooner and S. Asselin (editors), Le developpmente du saumon Atlantique au Quebec: connaitre les regles du jeu pour reussir. Colloque international e la Federation quebecoise pour le saumon atlantique, p. 128-141. Quebec, decembre 1992. Collection *Salmo salar* n°1.

Slaney, P.A., B.R. Ward, and J.C. Wightman. 2003. Experimental nutrient addition to the Keogh River and application to the Salmon River in coastal British Columbia. *In* J.G. Stockner,(editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 111-126. American Fisheries Society, Symposium 34, Bethesda, Maryland.

SIWG (Species Interaction Work Group). 1984. Evaluation of potential species interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh, editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Department of Fisheries. Olympia, WA. 80pp.

Stockner, J. G., editor. 2003. Nutrients in salmonid ecosystems: sustaining production and biodiversity. American Fisheries Society, Symposium 34, Bethesda, Maryland.

Taylor, E.B. 1991. A review of local adaptation in Salmonidae with particular reference to Pacific and Atlantic salmon. Aquaculture 98: pp. 185-207.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.

United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) Order Adopting Puget Sound Management Plan, 1985.

Ward, B.R., D.J.F. McCubbing, and P.A. Slaney. 2003. Evaluation of the addition of inorganic nutrients and stream habitat structures in the Keogh River watershed for steelhead trout and coho salmon. . *In* J.G. Stockner,(editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 127-147. American Fisheries Society, Symposium 34, Bethesda, Maryland.

Washington Department of Fish and Wildlife and Washington Treaty Indian Tribes. 1998. Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Olympia.

Washington Department of Fish and Wildlife and Washington Treaty Indian Tribes. 1999. Current Brood Document.

Washington Department of Fish and Wildlife. 1996. State of Washington Fish Health Manual. Hatcheries Program, Fish Health Division. Olympia.

Wipfli, M.S., J. Hudson, and J. Caouette. 1998 Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquat. Sci. 55: 1503-1511.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook ESU/Population: Puget Sound Activity: Hatchery Operations				
Location of hatchery activity: Issaquah Cr. Dates of activity: October-April Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*